Supplemental Environmental Data Summary and Evaluation Northwest Pipe Company Portland Plant

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This memorandum compiles environmental data on settled solids samples from catch basins, a storm water line section, and a sump that have been collected at Northwest Pipe Company's Portland facility and provides an evaluation of selected data in context with prior contaminant fingerprinting work presented in CH2M HILL (2010).

Data Collection

The following samples of settled solids have been collected at the Northwest Pipe Company Portland facility:

- In 2011, one sample of settled solids was collected from the easternmost storm water line prior to routine maintenance cleaning facilitated by the 2011 installation of cleanout ports in this line. Before these cleanout ports were installed, the geometry of the easternmost line was such that it could not be accessed for cleaning as other lines at the plant routinely are cleaned. This sample was collected for waste characterization purposes and the results are presented in Table 1.
- In 2006, settled solids samples were collected from five catch basin locations at the property: CB-101, CB-110, CB-111, CB-112 and CB-106. Sample results are presented in Table 2. These data were provided to DEQ on September 3, 2008 as handouts in a meeting to discuss the scope of additional investigation activities that DEQ required but had not otherwise been documented.
- In 1989, two samples of settled solids (and two duplicates) were collected from the Area 14 wash pad sump by Dames & Moore (1989). Results of this sampling are presented in Table 3.

Sample locations are shown in Figure 1.

The sump feature in Area 14 has been incorrectly described in multiple documents. Dames & Moore (1989) referred to the sump as a "plugged storm drain." Hart Crowser (1994) also misidentified the feature as an "opening to a 100-gallon UST." Further investigation by Northwest Pipe maintenance staff determined that this feature was a large (approximately six feet deep) underground containment sump that evidently was associated with past use of the former Beall Pipe and Tank Corporation wash pad. It has an outlet near its top that, if the sump filled with water, could serve as an overflow outlet. URS (2000) indicated that this outlet is connected to the facility storm water system. In 1989, Crosby & Overton removed two feet of settled solids from the bottom of the sump (CH2M HILL 2001).

Data Evaluation

Because of new data being collected from the storm line along the east side of the plant, the CH2M HILL (2010) report was re-evaluated in part to place the new data into context. The polychlorinated biphenyl (PCB) Aroclor data for selected sediment samples were also reviewed to confirm their accuracy. A review of polynuclear aromatic hydrocarbon (PAH) data was completed to supplement the analysis presented in CH2M HILL (2010) to evaluate whether PAHs at the site show evidence of being related to historical fires that occurred prior to Northwest Pipe Company operations at the site. Lastly, soil data from the former Union Carbide/Elkem facility

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nearby was reviewed in light of new information that storm water from that plant historically had flowed to and ponded at the Northwest Pipe facility. This section presents the results of this work.

Data from Easternmost Storm Line

The nature of PCB Aroclors and the Environmental Protection Agency (EPA) Fingerprinting Evaluation of Landfill Contaminants (FALCON) method (EPA 2004) were used to evaluate contaminants reported in the sample collected from the east storm water line where a clean-out port recently was installed.

Aroclor 1254 was the only Aroclor detected in the east storm water line solids sample at 14.3 milligrams per kilogram (mg/kg). This is consistent with upland soil results where Aroclor 1254 is the dominant Aroclor with a maximum previously-reported concentration similar in magnitude (13.465 mg/kg). It also is generally consistent with sediment cores collected near Outfall 18, which predominately contained Aroclor 1254; however, the presence of Aroclor 1260 in association with Aroclor 1254 in deeper sediment samples that correlate with shipyard operations (see explanation of correlating depth and time below) is not reflected in the east storm water line sample, as no Aroclor 1260 was detected in that sample. Consequently, the PCB occurrence in the line is inconclusive as to whether it is closely linked with historical shipyard operations.

The PAHs reported in the east storm water line pipe sample were compared with the fingerprint of the average Northwest Pipe Upland soil results presented in CH2M HILL (2010). The attached work sheet and chart present the results of the comparison using the FALCON method. The correlation between the east storm water line pipe sample and the Northwest Pipe upland fingerprint at 0.636 is relatively weak. A review of the graphic fingerprints indicates that east storm water line pipe solids do not closely match Northwest Pipe upland soil conditions (the greatest differences are with acenaphthene, fluorene, phenanthrene, benz[a]anthracene, chrysene, benzo[b]fluoranthene, benzo[k]fluoranthene, benzo[g,h,i]perylene, and indeno[1,2,3-cd]pyrene), suggesting an alternate source for the PAHs present in the east storm water line other than present-day site soil.

Because the storm line could not be cleaned prior to installation of the cleanout ports in 2011, it is possible that the settled solids and associated contaminants found in the east storm water line may date from prior to Northwest Pipe's operations. If that were the case, then it reasonably would be expected that the distribution of PAHs in the east storm water line may more closely match PAHs in deep sediment near Outfall 18 that likely was deposited during the period when shipyard operations were occurring. Using the 1.1 inch/year sediment deposition rate estimated by CH2M HILL (2010), the primary period of shipyard operations (1941 through 1945) would have correlated to the sediment interval situated at approximately 5.9 to 6.2 feet below the sediment surface at the time sediment cores were advanced in 2009. Applying the EPA FALCON method to the two cores advanced by CH2M HILL near outfall 18 (SED01 and SED02) yields the results listed in Table 1.

TABLE 1 FALCON REGRESSION COR	RRELATION BETWEEN SEDIMENT CORE SAMPLES AND EAS	ST STORM LINE SOLIDS
Sample and Depth Interval	Approximate Time of Deposition	Regression Coefficient (Ranges from zero to 1, higher value means better correlation)
SED01 2.5 – 5.0	1954 to 1985 (100 percent after shipyard operations)	0.720
SED01 5.0 – 6.5	1938 TO 1954 (before, during, and after shipyard operations; shipyard operational period represents 31 percent of sample interval, with 81 percent of sample interval represented by the period during and after shipyard operations)	0.839
SED02 2.5 – 5.0	1954 to 1985 (100 percent after shipyard operations)	0.712

TABLE 1 FALCON REGRESSION COP	RRELATION BETWEEN SEDIMENT CORE SAMPLES AND EAS	ST STORM LINE SOLIDS
Sample and Depth Interval	Approximate Time of Deposition	Regression Coefficient (Ranges from zero to 1, higher value means better correlation)
SED02 5.0 – 8.5	1916 to 1954 (before during, and after shipyard operations; shipyard operational period represents 13 percent of sample interval, with 34 percent of sample interval represented by the period during and after shipyard operations)	0.640

Although the calculated PAH correlations are fairly close in magnitude, they are fully consistent with the assumption that the settled solids in the east storm water line are old and likely pre-date Northwest Pipe's operations at the site. This conclusion is based on the following observations:

- The correlation between PAHs in the east storm water line and upland site soil is weak, at 0.636, indicating that current site surface soil is not well-correlated to PAHs in the storm water line and suggesting an alternate source for those PAHs.
- If the shipyard operations were the source of the PAHs in the east storm water line, the best correlation would be expected to be with the sediment core sample interval that most closely aligns with shipyard operations, under the assumption that shipyard-related contaminants would be most prevalent during the period of shipyard operations and in the few years thereafter; with the correlation diminishing over time as future operations and events occurred at the site. This is precisely what is observed in the correlations, as the sediment core sample that is most closely aligned with shipyard operations (sample SED01 5.0-6.5, which covers the approximate depositional period 1938 to 1954, 31 percent of which coincides with shipyard operations and 81 percent of which coincides with the period of shipyard operations plus the subsequent years immediately thereafter), which had the highest calculated correlation in this comparison, at 0.839.
- The two samples that entirely represent the period *after* shipyard operations (SED01 2.5 5.0 and SED 02 2.5 5.0) have somewhat weaker correlations (0.712 to 0.720) to the east storm water line solids; yet still greater than that observed with Northwest Pipe upland soils. This is consistent with a contaminant relationship that is diminishing over time following the cessation of shipyard operations.
- Finally, the sample interval that primarily (66 percent of its length) represents the period *prior* to shipyard operations (SED02 5.0 to 8.5) has the weakest correlation of the sediment samples examined, at 0.640.

As noted above, each of these observations of PAH correlation is consistent with the assumption that the contaminants identified in the settled solids found within the east storm water line predate Northwest Pipe's operations at the site and most likely date from shortly after the line was installed during shipyard construction and operations.

Selected PCB Data Review

To resolve uncertainty about certain PCB data presented in CH2M HILL (2010), the data were checked and an error was identified in the magnitude and ratio presented for sample point 03R004. The correct values are as follows:

 The magnitude of the total PCB Arclor concentration should be 0.346 mg/kg instead of 0.73 mg/kg, as originally reported

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• The Aroclor ratios should be 22.6 percent for 1254, 13.7 percent for 1260, and 63.7 percent for the remaining Aroclors (instead of the originally-calculated 24 percent, 17 percent, and 58 percent respectively).

Sample point T4-VC01 is correct as originally reported in CH2M HILL (2010).

The corrections noted above do not change the conclusion presented in CH2M HILL (2010) that PCB Aroclors in river sediment near Schnitzer International Terminals storm water outfall No. 1 are different in nature than PCB Aroclors identified at the Northwest Pipe facility due to the preponderance of PCB Aroclors other than 1254 and 1260 in the sediment samples.

Potential Effect on PAHs from Historical Facility Fires

The facility now owned by Northwest Pipe Company was the location of several fires during its history as an industrial operation. The principal fire events occurred in 1944, 1945, and 1961. The 1961 fire resulted in the entire assembly building (the large manufacturing building at the site) burning down.

PAHs can form during combustion of coal, wood, and similar vegetative materials, or by burning petroleum products. Such PAHs are commonly referred to as pyrogenic PAHS, as compared with PAHs associated with non-cumbusted petroleum products, which are referred to as petrogenic PAHs. The PAH data at the site were evaluated using a method presented by Yunker et al. (2002), which suggests that the concentration ratio of fluoranthene to the sum of fluoranthene + pyrene (FI/[FI+Py]) provides an indication of the source of observed PAHs in the environment. Specifically, the following delimeters suggested by Yunker et al. (2002) were used:

- A FI/(FI+Py) ratio <0.4 implies petrogenic PAHs (PAHs arising from non-combusted petroleum products)
- A FI/(FI+Py) ratio between 0.4 and 0.5 implies lower-temperature pyrogenic PAHs (typically attributed to petroleum combustion)
- A FI/(FI+Py) ratio >0.5 implies higher-temperature pyrogenic PAHs (typically attributed to combustion of coal, grass and/or wood)

The concentration ratio was calculated for Northwest Pipe upland soil and surface sediment samples from the IT Slip collected by CH2M HILL (2010). For upland soil the concentration ratio ranged from 0.48 to 0.54 with an average of 0.51. For sediment the concentration ratio ranged from 0.42 to 0.54 with an average of 0.49. These data suggest PAHs detected in upland soil and sediment in the vicinity of outfall 18 are pyrogenic in origin; most likely originating from a combination of petroleum combustion and combustion of wood, or possibly grain, potentially associated with historic fires at the facility.

Potential Effect of Storm Water On-Flow from the Union Carbide/Elkem Site

Sample data from the draft Remedial Investigation (RI) report for the Union Carbide/Elkem site (Parsons 2002) were reviewed and both surface and near-surface soil samples closest to Northwest Pipe property were evaluated. No PCB Aroclors were detected in the Union Carbide/Elkem soil samples. However, analytical laboratory data sheets were not available to review, so it could not be determined if this outcome was caused by elevated analytical reporting limits that may have masked lower-concentration PCB Aroclors. PAH-SIM analysis (selected ion monitoring; an analytical enhancement that yields lower reporting limits) were not conducted on Union Carbide/Elkem soil samples. Instead semivolatile organic compounds (which also include PAHs) were analyzed resulting in a higher reporting limit for PAH constituents. Accordingly, no PAH constituents were detected above the reporting limits. PAH constituents (benzo(a)pyrene, benzo(b)fluoranthene, chrysene, fluoranthene and pyrene) were detected below the reporting limit but above the method detection limit at one sample location at estimated concentrations ranging between 1.22 mg/kg and 1.93 mg/kg. Bis(2-ethylhexyl)phthalate was detected above its reporting limit at two of the sample locations reviewed. Reporting limits for PAHs in the Union Carbide/Elkem RI Report (Parsons 2002) ranged from 0.1 mg/kg to 2 mg/kg, compared to typical reporting limits for PAH-SIM analysis of 0.005 to 0.025 mg/kg, depending on dilution effects or matrix interference.

Because of the differences in reporting limits between data sets, a direct comparison of site sample results using methods such as the EPA FALCON analysis is not possible. However, based on comparison to the average Northwest Pipe upland soil fingerprint, the most concentrated PAH constituents at the Union Carbide site for those compounds that were detected above the method detection limit are similar to those identified in Northwest Pipe upland soil. Consequently, the correlation of the Union Carbide/Elkemn data to the Northwest Pipe site is inconclusive, but is possible.

References

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Figures and Tables

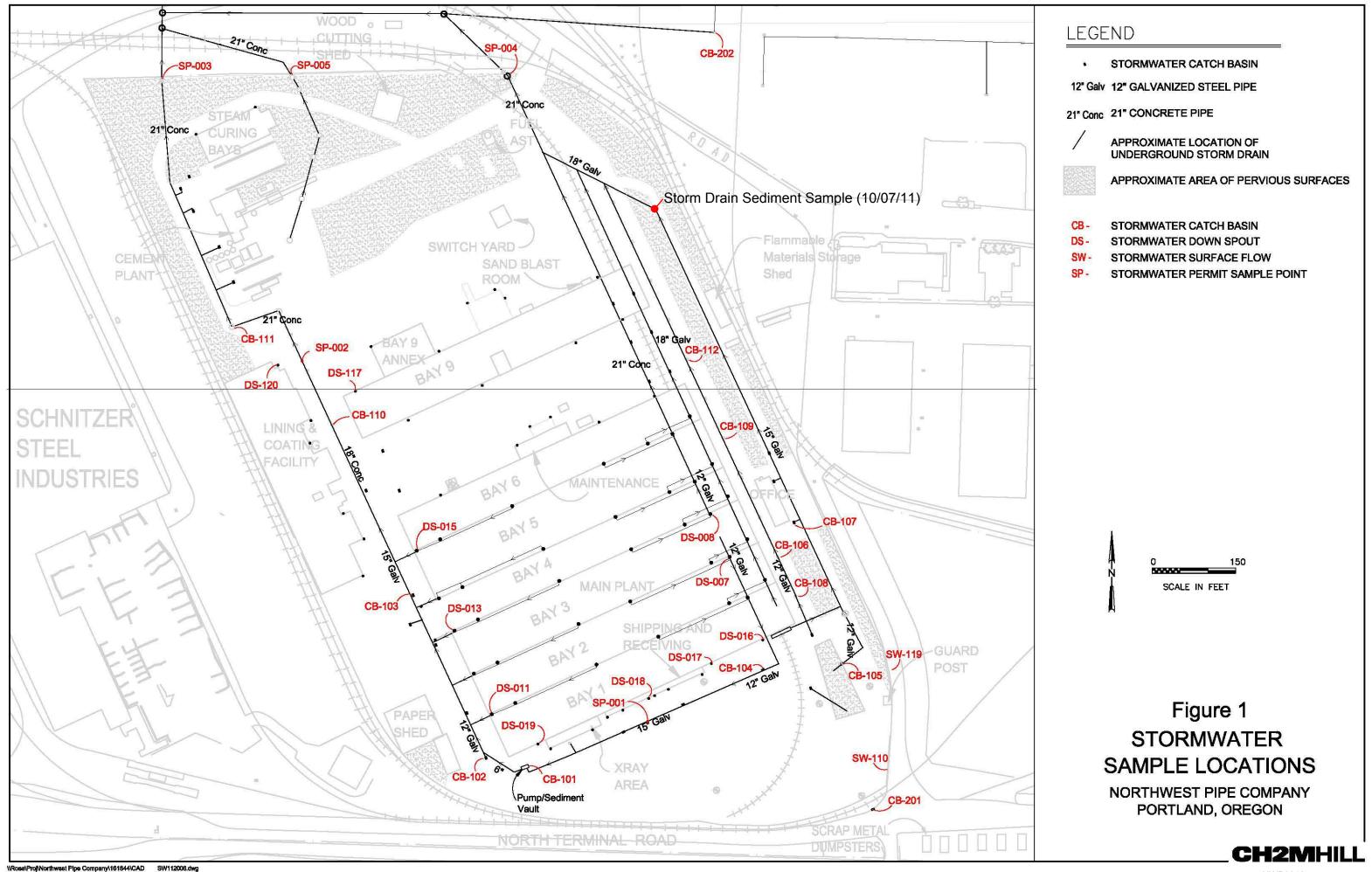


Table 12011 Storm Drain Sediment Analytical Results *NW Pipe Company*

	sample ID	Storm Drain Sediment
	sample date	10/7/2011
METALS (mg/kg)	·	
Arsenic		0.1 U
Barium		1.36
Cadium		0.1 U
Chromium		0.1 U
Lead		2.36
Selenium		0.2 U
Silver		0.1 U
Mercury		0.0078
PAHs (µg/kg)		
Acenaphthene		36,000
Acenaphthylene		677
Anthracene		42,700
Benzo (a) anthracene		83,500
Benzo (a) pyrene		77,700
Benzo (b) fluoranthene		104,000
Benzo (g,h,i) perylene		33,500
Benzo (k) fluoranthene		32,400
Chrysene		89,100
Dibenzo (a,h) anthracen	e	12,300
Fluoranthene		257,000
Fluorene		31,600
Indeno (1,2,3-cd) pyrene	:	32,000
Naphthalene		5,960
Phenanthrene		234,000
Pyrene		187,000
PCBs (µg/kg)		
Aroclor-1016		66.6 U
Aroclor-1221		66.6 U
Aroclor-1232		66.6 U
Aroclor-1242		66.6 U
Aroclor-1248		66.6 U
Aroclor-1254		14,300
Aroclor-1260		66.6 U
Aroclor-1262		66.6 U
Aroclor-1268		66.6 U

Table 2 Catch Basin Solids Analytical Results October 2006 Sampling Event

Northwest Pipe

Station:				CB-1	01	CB-1	10	CB-1	11	CB-1	12	CB-10	06
Sample ID:				CB-01	-0	CB-02	2-0	CB-0	3-0	CB-04	-0	CB-05	5-0
Date Sampled:				10/04/	06	10/04/	06	10/04	/06	10/04/	06	10/04/	06
Chemical Group	Parameter	Units	Portland Harbor JSCS ^{1,2}										
M-TOTAL	Zinc	mg/Kg	459	3,050		1,170		1,640		174		467	
PAH	Acenaphthene	mg/Kg	0.30	0.37		0.61		5.3	D	0.19		0.18	
PAH	Acenaphthylene	mg/Kg	0.20	0.38		0.035		0.17		0.031		0.15	
PAH	Anthracene	mg/Kg	0.85	2.0		1.6		21	D	0.65		0.60	
PAH	Benzo (a) anthracene	mg/Kg	1.1	9.9	D	3.4	D	14	D	1.6		1.6	
PAH	Benzo (a) pyrene	mg/Kg	1.5	7.2	D	1.9	D	7.7	D	1.2		1.3	
PAH	Benzo (b) fluoranthene	mg/Kg		13	D	3.4	D	13	D	1.5		1.9	
PAH	Benzo (g,h,i) perylene	mg/Kg	0.30	4.5	D	1.1		6.1	D	0.66		0.91	
PAH	Benzo (k) fluoranthene	mg/Kg	13	2.5		1.0		2.8		0.56		0.72	
PAH	Chrysene	mg/Kg	1.3	15	D	3.9	D	16	D	1.9	D	2.3	
PAH	Dibenzo (a,h) anthracene	mg/Kg	1.3	1.1		0.41		1.3		0.25		0.33	
PAH	Fluoranthene	mg/Kg	2.2	19	D	8.4	D	43	D	3.9	D	4.0	D
PAH	Fluorene	mg/Kg	0.54	0.62		0.76		9.7	D	0.22		0.24	
PAH	Indeno (1,2,3-cd) pyrene	mg/Kg	0.10	4.3	D	0.97		3.3		0.59		0.83	
PAH	Naphthalene	mg/Kg	0.56	0.12		0.38		1.1		0.046		0.26	
PAH	Phenanthrene	mg/Kg	1.2	7.1	D	6.5	D	42	D	2.4	D	1.9	
PAH	Pyrene	mg/Kg	1.5	18	D	6.9	D	35	D	3.2	D	3.6	D
PEST/PCB	Aroclor-1254	mg/Kg	0.30	1.7		0.86		14		0.31		0.50	
PEST/PCB	Aroclor-1260	mg/Kg	0.20	0.27		0.10	U	1.7	U	0.071		0.080	
TPH	Diesel by Dx	mg/Kg	70,000	884		180		846		115		382	

Notes:

D = Data reported from a preparation or analytical dilution.

U = Not detected at specified reporting limit.

Bold result = detection

Shaded = detected result exceeded screening criteria

^{-- =} Not Established

¹ Portland Harbor Joint Source Control Strategy (JSCS) Table 3.1 (July 16, 2007). Initial upland source control screening evaluation criteria for soil and stormwater sediment.

² Diesel screening value from Oregon Department of Environmental Quality Risk-Based Concentrations table; Soil Injestion, Dermal Contact, and Inhalation for Occupational Worker (Rev. July 4, 2007).

Table 3.

Area 14 Catch Basin Sediment Sample Detected Results (Table 11 in Dames & Moore [1989] report)

			CHLORINATE	SOLVEN	ms_		POLYNULEAR AROMATICS									
AREA	SAMPLE	SAMPLE DEPTH (FEET)	1,1,1 TRI- CHLOROETHANE	FCE	TŒ	TPH	PHENAN THRENE	ANTHRA- CENE	FLUORAN- THENE	PYRENE	HENZO ANTHRA- CENE	TOTAL BENZO FLOURANTHENE	HENZO PYREME	DIBENZ ANTHRACENE	BENZO PERYLENCE	INDENO PYRENE
14	14-5-01	3	<.005	0.073	<.005	NI									•	-4
	14-6-02	3	NT	NI	NP	2,500	12	<23	7.87	14	4.2	8.91	6.61	1.3	6.4	15
(Duplicate)	14-S-03	3	<.005	0.055	<.005	NI		34		*						
(Duplicate)	14-S-04	3	NI	NI	NT	3,300	26	46	18	40	8.3	16.8	8.9	3.2	6.4	8.0

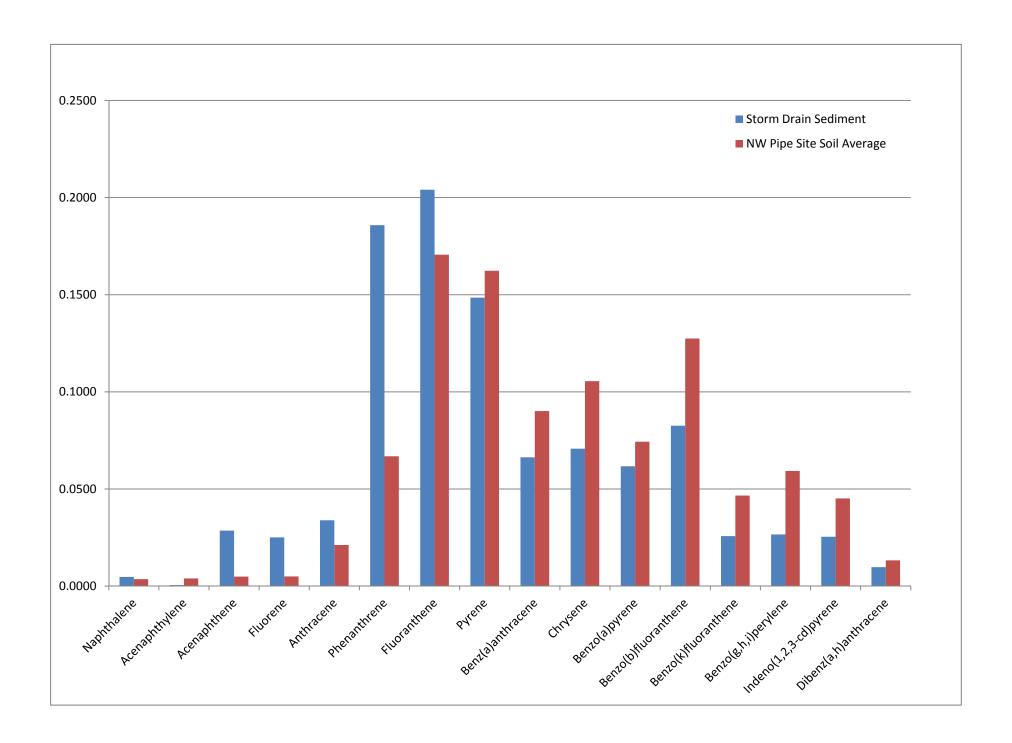
<0.1 Indicates compound not detected at specified detection limit

NT: Indicates sample not tested for compound

Note: All results listed in parts per million (ppm) unless otherwise noted

WD40:NW.T11

FALCON Worksheets



Storm Drain Sediment Sample

FALCON Analysis

NW Pipe - PAH Evaluation

Step 2 - PAH SIM Surface Soil Results for OF18 Drainage Basin Samples (ug/kg, NDs set equal to 1/2 detection limit)

PAH SIM	Chemical	Ū	Soil Sampling Locations
Analyte	Number		Storm Drain Sediment
Naphthalene		1	5,960
Acenaphthylene		2	677
Acenaphthene		3	36,000
Fluorene		4	31,600
Anthracene		5	42,700
Phenanthrene		6	234,000
Fluoranthene		7	257,000
Pyrene		8	187,000
Benz(a)anthracene		9	83,500
Chrysene		10	89,100
Benzo(a)pyrene		11	77,700
Benzo(b)fluoranthene		12	104,000
Benzo(k)fluoranthene		13	32,400
Benzo(g,h,i)perylene		14	33,500
Indeno(1,2,3-cd)pyrene		15	32,000
Dibenz(a,h)anthracene		16	12,300
Sum 1-16			1,259,437

Step 3 - Normalized PAH SIM Results

Chemical

	Number	Storm Drain Sediment	NW Pipe Site Soil Average
Naphthalene	1	0.0047	0.0036
Acenaphthylene	2	0.0005	0.0040
Acenaphthene	3	0.0286	0.0049
Fluorene	4	0.0251	0.0050
Anthracene	5	0.0339	0.0212
Phenanthrene	6	0.1858	0.0668
Fluoranthene	7	0.2041	0.1706
Pyrene	8	0.1485	0.1623
Benz(a)anthracene	9	0.0663	0.0901
Chrysene	10	0.0707	0.1055
Benzo(a)pyrene	11	0.0617	0.0743
Benzo(b)fluoranthene	12	0.0826	0.1274
Benzo(k)fluoranthene	13	0.0257	0.0466
Benzo(g,h,i)perylene	14	0.0266	0.0592
Indeno(1,2,3-cd)pyrene	15	0.0254	0.0451
Dibenz(a,h)anthracene	16	0.0098	0.0133

Step 5 - Regression anaysis Comparison of Fingerprint Pattern

	Storm Drain Sediment
NW Pipe Site Soil Average	0.636

Worksheet 2 Outfall 18 Drainage Basin Surface Soil Samples FALCON Analysis NW Pipe - PAH Evaluation

Step 2 - PAH SIM Surface Soil Results for OF18 Drainage Basin Samples (ug/kg, NDs set equal to 1/2 detection limit)

PAH SIM	Chemical	Soil Sampl	ling Locatio	ns						
Analyte	Number	SS-01-0	SS-05-0	SS-08-0	SS-09-0	SS-13-0	SS-15-0	SS-18-0	SS301	S
Naphthalene	1	1.15	45.6	84.3	72.1	142	4.4	466	3.63	
Acenaphthylene	2	6.1	85.5	317	48.8	340	8.4	329	3.51	
Acenanhthene	3	1 15	92.6	97	347	577	12.5	1.850	6.68	

Analyte	Number	SS-01-0	SS-05-0	SS-08-0	SS-09-0	SS-13-0	SS-15-0	SS-18-0	SS301	SS302	SS304	SS305	SS305	SS307	SS309	SS310	SS312	SS313	SS315	SS316	SS318	SS320	SS321
Naphthalene	1	1.15	45.6	84.3	72.1	142	4.4	466	3.63	2.84	43.4	127	156	67.9	103	50.1	308	14.4	5.49	1.95	10.4	22.8	599
Acenaphthylene	2	6.1	85.5	317	48.8	340	8.4	329	3.51	2.81	4.92	64.6	108	179	33.1	46.6	47.4	21.2	12.9	3.2	90.9	240	90
Acenaphthene	3	1.15	92.6	97	347	577	12.5	1,850	6.68	5.38	10.3	500	703	82.1	90	163	2030	19.3	3.67	4.63	24.7	24	3720
Fluorene	4	2.5	65.2	111	385	505	8.7	2,350	6.02	3.86	13.3	521	978	38.9	110	167	1920	8.18	4.04	4.43	12.2	47.2	3070
Anthracene	5	17.2	364	814	1,020	1,800	99.8	10,200	27	13.8	20.2	1420	2710	417	312	602	4820	76.2	22.7	17.8	200	603	19200
Phenanthrene	6	22.5	1,130	2,280	4,990	10,200	125	27,700	82.4	56.2	105	6660	12300	936	1340	2320	24800	257	43.3	68.3	232	361	61000
Fluoranthene	7	64.6	4,920	13,500	9,470	24,900	435	59,200	370	155	187	12300	23800	3860	3520	5120	33900	649	142	167	1880	2370	166000
Pyrene	8	62	4,900	14,400	8,170	22,400	444	52,600	404	157	171	9870	19300	4050	3270	4690	28200	623	146	153	2120	2480	175000
Benz(a)anthracene	9	40.4	3,680	8,600	5,120	13,200	299	33,800	256	87.8	95.8	5110	9000	2500	1670	2200	9380	330	84.1	84.3	1570	1470	51600
Chrysene	10	60.5	4,600	9,680	5,210	15,100	354	36,700	279	107	106	4660	8520	2750	1730	2290	9670	382	113	82.8	2820	2150	57300
Benzo(a)pyrene	11	51.7	2,780	4,970	3,280	8,940	274	18,700	246	88.9	90.3	3480	6660	2520	1660	1960	7830	356	99.9	88.8	734	917	38200
Benzo(b)fluoranthene	12	73.2	4,350	7,430	5,050	13,800	416	30,800	425	141	156	5250	9930	4310	2460	2630	9810	663	275	137	2180	2780	58200
Benzo(k)fluoranthene	13	26.7	1,280	2,980	1,430	5,070	167	11,800	153	46.1	51.2	2110	3350	1620	937	1270	6530	248	66.3	48.5	845	941	30100
Benzo(g,h,i)perylene	14	36.8	1,630	3,690	2,790	7,180	245	13,700	219	88.9	84.5	2030	4160	2140	1280	1370	4540	325	116	62.8	922	584	17500
Indeno(1,2,3-cd)pyrene	15	29.3	1,370	3,030	2,320	6,160	194	12,700	155	64.5	59.8	1510	3190	1570	885	983	3250	241	86.4	49.2	598	481	14000
Dibenz(a,h)anthracene	16	9.5	565	942	644	1,310	79.1	4,710	39.9	14.9	15.5	438	910	399	227	245	1150	54.1	26.8	13.4	203	136	5400
Sum 1-16		505.3	31857.9	72925.3	50346.9	131624	3165.9	317605	2676.14	1035.99	1214.22	56050.6	105775	27439.9	19627.1	26106.7	148185	4267.38	1247.6	987.11	14442.2	15607	700979

Step 3 - Normalized PAH SIM Results

Otop o Horrida.	Chemical																						
	Number	SS-01-0	SS-05-0	SS-08-0	SS-09-0	SS-13-0	SS-15-0	SS-18-0	SS301	SS302	SS304	SS305	SS305	SS307	SS309	SS310	SS312	SS313	SS315	SS316	SS318	SS320	SS321
Naphthalene	1	0.0023	0.0014	0.0012	0.0014	0.0011	0.0014	0.0015	0.0014	0.0027	0.0357	0.0023	0.0015	0.0025	0.0052	0.0019	0.0021	0.0034	0.0044	0.0020	0.0007	0.0015	0.0009
Acenaphthylene	2	0.0121	0.0027	0.0043	0.0010	0.0026	0.0027	0.0010	0.0013	0.0027	0.0041	0.0012	0.0010	0.0065	0.0017	0.0018	0.0003	0.0050	0.0103	0.0032	0.0063	0.0154	0.0001
Acenaphthene	3	0.0023	0.0029	0.0013	0.0069	0.0044	0.0039	0.0058	0.0025	0.0052	0.0085	0.0089	0.0066	0.0030	0.0046	0.0062	0.0137	0.0045	0.0029	0.0047	0.0017	0.0015	0.0053
Fluorene	4	0.0049	0.0020	0.0015	0.0076	0.0038	0.0027	0.0074	0.0022	0.0037	0.0110	0.0093	0.0092	0.0014	0.0056	0.0064	0.0130	0.0019	0.0032	0.0045	0.0008	0.0030	0.0044
Anthracene	5	0.0340	0.0114	0.0112	0.0203	0.0137	0.0315	0.0321	0.0101	0.0133	0.0166	0.0253	0.0256	0.0152	0.0159	0.0231	0.0325	0.0179	0.0182	0.0180	0.0138	0.0386	0.0274
Phenanthrene	6	0.0445	0.0355	0.0313	0.0991	0.0775	0.0395	0.0872	0.0308	0.0542	0.0865	0.1188	0.1163	0.0341	0.0683	0.0889	0.1674	0.0602	0.0347	0.0692	0.0161	0.0231	0.0870
Fluoranthene	7	0.1278	0.1544	0.1851	0.1881	0.1892	0.1374	0.1864	0.1383	0.1496	0.1540	0.2194	0.2250	0.1407	0.1793	0.1961	0.2288	0.1521	0.1138	0.1692	0.1302	0.1519	0.2368
Pyrene	8	0.1227	0.1538	0.1975	0.1623	0.1702	0.1402	0.1656	0.1510	0.1515	0.1408	0.1761	0.1825	0.1476	0.1666	0.1796	0.1903	0.1460	0.1170	0.1550	0.1468	0.1589	
Benz(a)anthracene	9	0.0800	0.1155	0.1179	0.1017	0.1003	0.0944	0.1064	0.0957	0.0847	0.0789	0.0912	0.0851	0.0911	0.0851	0.0843	0.0633	0.0773	0.0674	0.0854	0.1087	0.0942	0.0736
Chrysene	10	0.1197	0.1444	0.1327	0.1035	0.1147	0.1118	0.1156	0.1043	0.1033	0.0873	0.0831	0.0805	0.1002	0.0881	0.0877	0.0653	0.0895	0.0906	0.0839	0.1953	0.1378	0.0817
Benzo(a)pyrene	11	0.1023	0.0873	0.0682	0.0651	0.0679	0.0865	0.0589	0.0919	0.0858	0.0744	0.0621	0.0630	0.0918	0.0846	0.0751	0.0528	0.0834	0.0801	0.0900	0.0508	0.0588	0.0545
Benzo(b)fluoranthene	12	0.1449	0.1365	0.1019	0.1003	0.1048	0.1314	0.0970	0.1588	0.1361	0.1285	0.0937	0.0939	0.1571	0.1253	0.1007	0.0662	0.1554	0.2204	0.1388	0.1509	0.1781	0.0830
Benzo(k)fluoranthene	13	0.0528	0.0402	0.0409	0.0284	0.0385	0.0527	0.0372	0.0572	0.0445	0.0422	0.0376	0.0317	0.0590	0.0477	0.0486	0.0441	0.0581	0.0531	0.0491	0.0585	0.0603	0.0429
Benzo(g,h,i)perylene	14	0.0728	0.0512	0.0506	0.0554	0.0545	0.0774	0.0431	0.0818	0.0858	0.0696	0.0362	0.0393	0.0780	0.0652	0.0525	0.0306	0.0762	0.0930	0.0636	0.0638	0.0374	0.0250
Indeno(1,2,3-cd)pyrene	15	0.0580	0.0430	0.0415	0.0461	0.0468	0.0613	0.0400	0.0579	0.0623	0.0492	0.0269	0.0302	0.0572	0.0451	0.0377	0.0219	0.0565	0.0693	0.0498	0.0414	0.0308	
Dibenz(a,h)anthracene	16	0.0188	0.0177	0.0129	0.0128	0.0100	0.0250	0.0148	0.0149	0.0144	0.0128	0.0078	0.0086	0.0145	0.0116	0.0094	0.0078	0.0127	0.0215	0.0136	0.0141	0.0087	0.0077

Sten	5 -	Regression	anaveie	Comparison	of F	ingernrint	Pattern

	SS-01-0	SS-05-0	SS-08-0	SS-09-0	SS-13-0	SS-15-0	SS-18-0	SS301	SS302	SS304	SS305	SS305	SS307	SS309	SS310	SS312	SS313	SS315	SS316	SS318	SS320	SS321
SS-01-0		0.916	0.783	0.732	0.791	0.966	0.734	0.955	0.937	0.822	0.597	0.597	0.959	0.848	0.727	0.395	0.930	0.839	0.886	0.833	0.879	0.544
SS-05-0			0.932	0.831	0.894	0.948	0.858	0.920	0.916	0.835	0.700	0.693	0.916	0.880	0.802	0.473	0.875	0.683	0.882	0.907	0.913	0.667
SS-08-0				0.889	0.947	0.880	0.924	0.832	0.873	0.821	0.801	0.802	0.832	0.904	0.888	0.605	0.814	0.516	0.865	0.804	0.835	0.835
SS-09-0					0.984	0.810	0.985	0.750	0.861	0.917	0.958	0.956	0.761	0.940	0.970	0.831	0.830	0.489	0.910	0.639	0.719	0.878
SS-13-0						0.966	0.734	0.955	0.937	0.822	0.597	0.597	0.959	0.848	0.727	0.395	0.868	0.537	0.932	0.725	0.791	0.880
SS-15-0							0.817	0.975	0.973	0.858	0.674	0.675	0.974	0.906	0.805	0.463	0.945	0.785	0.923	0.845	0.884	0.645
SS-18-0								0.744	0.838	0.879	0.944	0.939	0.755	0.922	0.960	0.805	0.807	0.466	0.887	0.692	0.768	0.891
SS301									0.968	0.856	0.620	0.622	0.998	0.890	0.760	0.408	0.962	0.860	0.919	0.818	0.884	0.598
SS302										0.928	0.740	0.746	0.970	0.952	0.860	0.547	0.976	0.787	0.963	0.782	0.841	0.701
SS304											0.857	0.859	0.867	0.959	0.914	0.709	0.935	0.687	0.958	0.661	0.773	0.777
SS305												0.998	0.640	0.889	0.967	0.938	0.740	0.375	0.848	0.488	0.626	0.932
SS305													0.643	0.894	0.970	0.938	0.743	0.379	0.852	0.479	0.621	0.942
SS307														0.903	0.778	0.430	0.973	0.862	0.933	0.806	0.892	0.616
SS309															0.966	0.726	0.948	0.657	0.990	0.685	0.813	0.856
SS310																0.859	0.851	0.492	0.933	0.596	0.727	0.941
SS312																	0.557	0.212	0.675	0.289	0.416	0.878
SS313																		0.843	0.975 0.728	0.737	0.863 0.764	0.691
SS315																			0.726	0.687	0.764	0.329
SS316																				0.687		0.795
SS318																					0.894	0.478
SS320		-																				0.029
SS321																						

average regression alaysis comparison = 0.795 Min 0.212 stdevp = 0.998 less than 0.5 regression

